

XV.

THE DIAGNOSTIC VALUE

OF AN

ACCENTUATED CARDIAC SECOND SOUND.

(Communicated to the *Hunterian Medical Society*, March 27th, 1863, and
reprinted from the '*Edinburgh Medical Journal*,' June, 1863.)

It is now universally admitted that the second sound of the heart is produced during the act of closure of the semilunar valves in the orifices of the aorta and pulmonary artery. The sudden tension of the membranous structure of which these valves are composed is a sufficient, possibly the *only*, cause of the sound. It is, however, probable that, as generally held, the recoil of the blood against the valves contributes to its production.

Careful clinical observation has materially aided the direct experiments which, at a former period, were made regarding the heart's sounds. As respects the second sound, it may indeed be concluded that, by the former means of research, much left unfulfilled by the latter has been supplied. For example, I may refer to one or two particulars of importance, which have a special bearing on the subject of this paper. When the second sound is entirely replaced over the base of the heart by a murmur, it is not audible over the ventricles, and is not to be detected at the apex of the organ. In other words, when the murmur of aortic regurgitation is so loud as to drown all

normal second sound, preventing, by its very loudness, the recognition of the pulmonary second sound over the pulmonary valves, or in their immediate neighbourhood, where the second sound originating there is most readily heard, it cannot be detected even in small part over any other portion of the heart. Here, however, there are some points worthy of special observation; they concern what may be called exceptional cases of aortic insufficiency. A diastolic murmur may largely obscure, but not obliterate, the second sound over the aortic valves, a portion of it remains; and in such cases, the pulmonary second sound being either readily appreciable or at least audible, the murmur diminishing in loudness as the stethoscope is placed over the ventricles, the normal second sound, pulmonary in origin, or the portion of aortic second sound which remains, is with greater readiness discovered there, or even at the left apex, than at the base. In endeavouring to account for this circumstance, it must be held in remembrance that the murmur of aortic regurgitation is not conducted with anything like the same distinctness over the ventricles as it is down the course of the sternum to the very limit, in some instances, of the ensiform cartilage itself. I have found not unfrequently that the second sound, greatly obscured by murmur at the base, and having precisely the same character at the end of the sternum, has been partially unclouded at the left apex, and over the ventricles a little less so. In such instances, it has not been difficult to determine that the more ready recognition of the sound in the latter situations has been due to the loss in distinctness sustained by the murmur.

Dr. Walshe has noticed "a distinct sound at the left apex in more than one case, while at the aortic base the ordinary regurgitant murmur alone existed."¹ So also in cases in which the second sound at the base is only feebly heard—no murmur existing—there may be, if not a loud, at all events a more readily recognised second sound near or at the apex. To such instances Skoda has directed attention, and they have likewise been fully considered by Dr. Walshe. In explanation of their occurrence it may be, as Skoda has suggested, and Dr. Walshe is disposed to allow, that some of the phenomena occurring during the diastolic action of the ventricles, which are properly

¹ 'Diseases of the Heart,' third edition, p. 65.

or rather naturally, soundless, become attended by sound—in other words, produce a second sound of their own; or it is equally conceivable—although perhaps not fully established—that certain diseased states in existence may determine a sound bearing a resemblance, more or less exact, to the normal diastolic sound of the heart.

These few observations I have made by way of preface to the statement of great practical value which I now wish to consider,—That an accentuated condition of the heart's second sound is heard in connection with one or other of two conditions of disease—aneurysm of the aorta, or dilatation of the aorta. It is hardly necessary to say, that no account is taken here of the by no means uncommon phenomenon of an accentuated pulmonary second sound. All careful auscultators know of how much value that phenomenon is in relation to the condition of mitral valve constriction. In describing the heart's second sound as accentuated in the instances of aortic aneurysm and aortic dilatation upon which the present observations are based, it is perhaps necessary to explain that the expressions, intensified, or greatly pronounced, would equally well indicate the character of the sound which has been found to exist. When occurring under the circumstances referred to, the accentuation of the second sound is always well-marked. I have frequently observed that early auscultators have, unaided, noticed the peculiarity, while very rarely indeed has there been difficulty attending its recognition by such, when their attention has been called to the subject. In a case of aortic aneurysm under my care last summer, there existed so accentuated a second sound over the base of the heart as to arrest the notice of all who examined the patient by auscultation. Several students, merely tyros in the art, readily recognised the *booming* character of the sound.

When the accentuated second sound occurs in connection with aortic aneurysm or aortic dilatation, it may be presumed that the semilunar valves are competent. Their insufficiency and the occurrence of an accentuated second sound are inconsistent; if the former lesion be in existence, a diastolic murmur is the necessary result. The influence of valvular disease in the production of murmurs in cases of aortic aneurysm is a point of the greatest importance for consideration. There may

be, of course, associated mitral valve disease, or tricuspid disease, and, if so, murmurs may be thus originated; but such association is to be regarded rather in the light of an accidental coincidence, and not by any means of the same importance as the occurrence of disease of the aortic valves. Judging from cases of aneurysm which have come under my own observation in hospital, I conclude that it is very common to find aortic valve insufficiency in connection with aortic aneurysm; while in such cases the diastolic murmur, usually a very loud or at least very distinct one, so characteristic of the former lesion, is the most prominent auscultatory phenomenon. The cases now referred to are very evidently not cases of valvular disease in the first instance, and subsequently of aneurysm; in none has there been any foregoing attack of rheumatism, in none any distinct rheumatic history. Neither are they examples of a mere accidental association. The relation of the valvular imperfection to the aneurysm is, I believe, of the greatest interest and importance, and in all, its occurrence has been subsequent to the disease of the vessel. If an aortic aneurysm attain to any considerable dimensions, and affect the ascending portion of the arch, the aortic valves are rendered incompetent; and being so we shall find the auscultatory phenomena connected with the latter lesion in existence, and likewise the other physical signs which afford such evidence, especially the well-known peculiarities in the pulses, as pointed out by Dr. Corrigan and Dr. Henderson. I never remember to have seen an instance of aneurysm of the aortic arch within the pericardium of any considerable size unattended by diastolic murmur—the diastolic murmur of aortic valve insufficiency. On the other hand, the prominent physical signs of aortic insufficiency have led me—and no doubt the same error has been committed by others—to overlook the existence of aneurysm altogether. Dr. Haldane has in his possession a preparation of a large aortic aneurysm removed from a patient who had been under my own observation, as well as at different times under the care of three hospital physicians. In this case the signs of insufficiency of the semilunar valves were of unusual distinctness, and so, during the patient's life, the existence of that lesion was recognised, while the aneurism escaped detection till after death. The fatal event occurred suddenly, not from rupture of the aneurysm,

but after the mode in which a very sudden termination not unfrequently takes place in cases of aortic insufficiency. With these facts before us, how necessary is it to make a careful use of the other means of diagnosis, in addition to auscultation, which we possess.

There is no diseased condition within the chest which gives rise to so many and different auscultatory signs as aneurysm. I have no intention at present of making any detailed reference to these. My remarks will be limited now to one peculiarity—the *accentuated* second sound. Here I purposely avoid making any mention of the systolic cardiac sound. Of course, in all cases, it is of importance to determine its true state, whether pure, or itself accentuated, or attended by murmur; any of these it may be, while the accentuated character of the second sound prevails. Now, as the result of careful observation and continued attention, I have found that, excluding the accentuated pulmonary second sound, and the intensified aortic second sound in some cases of hypertrophy and dilatation of the left ventricle, the accentuated second sound in the aorta is an indication of aortic aneurysm, or of dilatation of the aorta associated with atheromatous degeneration. If it be the former, the aneurysm probably does not arise within the pericardium, and probably does not affect the ascending portion of the arch, but has most likely its seat in the transverse portion; it may, however, arise at an earlier part of the aorta, as was found in the following case:—

Aneurysm of the Aorta, pointing externally, bursting through the Lung into the Left Pleura.

S. M—, æt. 36, under my care in the Infirmary, Ward V, during August and September 1862. Between the second and third left ribs, near their cartilages, a pulsating tumour was detected on the patient's admission. On auscultation a soft bruit was audible over the tumour; and at the base of heart, as well as over the upper bone of sternum, a very loud ringing second sound. The latter phenomenon never varied during the patient's six weeks' residence in hospital. He died suddenly, after expectorating a little blood. On examination of the body after death, serous fluid and coagulated blood, to the amount of more than half a gallon, were found in the cavity of the left pleura; the heart was pushed downwards and backwards; it weighed fourteen ounces. *The valves were perfectly healthy.* An aneurysm was found commencing

abruptly an inch and a half above the semilunar valves—the whole vessel suddenly dilating to a point immediately beyond the origin of the left carotid, where the dilatation as suddenly ceased. The pouch so formed was six inches in length; it passed behind and was applied to the back of the manubrium sterni, and made its appearance externally between the second and third left ribs. The left extremity of the sac was intimately united to the left lung, the edge of which had become thinned by pressure, and the pleura having then given way, allowed the escape of the aneurysmal contents into the pleural sac.¹

In the foregoing case the peculiarity of the second sound was of comparatively little value in leading to the recognition of the aneurysm, other and still more distinctive signs, especially the visible pulsating tumour, of that condition being in existence; but the accentuated sound led to the diagnosis of the competency of the semilunar valves, which post-mortem examination confirmed. In the following case the accentuated second sound was the earliest noted reliable sign of aortic aneurysm.

W. M'A—, æt. 35, a hawker, was first seen by me in March, 1862, complaining of slight chest symptoms, particularly cough and expectoration of a little phlegm. Had not been a sober man.

Condition on first examination.—Has a slight bronchitic affection. Heart's second sound markedly accentuated over the aortic valves. No other auscultatory phenomenon connected with heart or great vessels.

I had frequent opportunities of seeing and examining this man up to November 6th, when he entered the Infirmary, becoming a patient in Ward IV. During this time his general health had failed considerably; he had become thinner, feebler, less able for his occupation, though still moving about and doing something as a traveller.

On 6th November the following notes of his condition were made:—Has been suffering from dyspnoea, which has seized him on a few occasions suddenly, and without any previous effort or exertion having been made. Cough is somewhat clanging in character. Has some pain and peculiar sense of weight in region of sternum. Over the left portion of manubrium there is visible pulsation—the latter readily distinguished on palpation. Left radial pulse is feebler than right. Murmur of soft blowing character accompanies first sound over the seat of pulsation, and is heard less distinctly over the base of heart. The second sound at base is of a loud *booming* character. Respiratory sounds in upper part of left lung, feeble. Posteriorly there is a little bronchial stridor.

¹ The post-mortem examination was performed by Dr. Haldane, at that time Pathologist to the Royal Infirmary, and the account given above has been abbreviated from his record of dissections.

This man, so far as I know, survives: he left the Infirmary about eight weeks since. With such signs as those detailed, the existence of aneurysm becomes unquestionable, they have become gradually developed in succession to the accentuated second sound, the earliest noticed of all.

Of this kind I might furnish other examples, several are known to me; and the opportunity has occurred for directing the attention of students to these, in the ordinary course of clinical instruction.

I have further to remark, that a similar condition of the second cardiac sound may be caused by dilatation of the aorta, associated with more or less of atheromatous degeneration. To distinguish between the two—in other words, to know when the accentuated second sound is due to aneurysm and when to dilatation of the aorta, is not always easy. Reliance is chiefly to be placed on the associated physical signs in the former case, more particularly prominence, pulsation, extended percussion dulness, and the signs of internal pressure. If atheromatous dilatation exist, and that is the special condition, independent of aneurysm, which gives rise to the accentuated second sound, there will probably be more or less pulsation in jugular fossa, atheromatous condition of superficial pulses (radials, temporal arteries, &c.) noticeable, and probably the *areus senilis*.

The following points appear to me to be of importance in endeavouring to explain the mechanism of an accentuated second sound, under the circumstances now considered:

1. The condition of the vessel both in cases of aneurysm and of dilatation with atheromatous degeneration, being such as greatly to diminish, if not to destroy, the support given to the circulation by the artery, there results an increased recoil of blood on the closing or closed valves.

2. It is possible that a morbid condition of the valvular apparatus itself heightens or intensifies the sound. The valves are not incompetent, but in such cases they are sometimes found thickened, and even presenting a hard surface at parts.

3. Something may, I conceive, be due to the increased calibre of the vessel, in connection with the altered condition of its internal tunie, in causing the peculiarity of sound.

But in whatever way the phenomenon is to be correctly explained, there can be no doubt of its existence being entitled

to very considerable value as a clinical fact. I have noticed that the accentuated second sound is most readily appreciable over the aortic valves in both conditions. In the cases of dilatation of the aorta it has, however, been more decided in character over the manubrium sterni than in aneurysmal cases. I may add, that in the majority of cases observed by myself, in which the accentuated second sound has existed under the circumstances now detailed, the expression, *booming* second sound, or second sound with *ringing boom*, has best described the acoustic character of the sound itself. I have known the booming sound continue for many weeks, and in one remarkable case of aneurysm lately observed (Walker, in Ward V, and afterwards in Ward IV), for months, and thereafter become at first obscured, and ultimately entirely replaced by a loud diastolic murmur, telling plainly that the semilunar valves had become insufficient owing to the extension of the disease towards the heart.